Off-Road Status Review

October 24, 2002

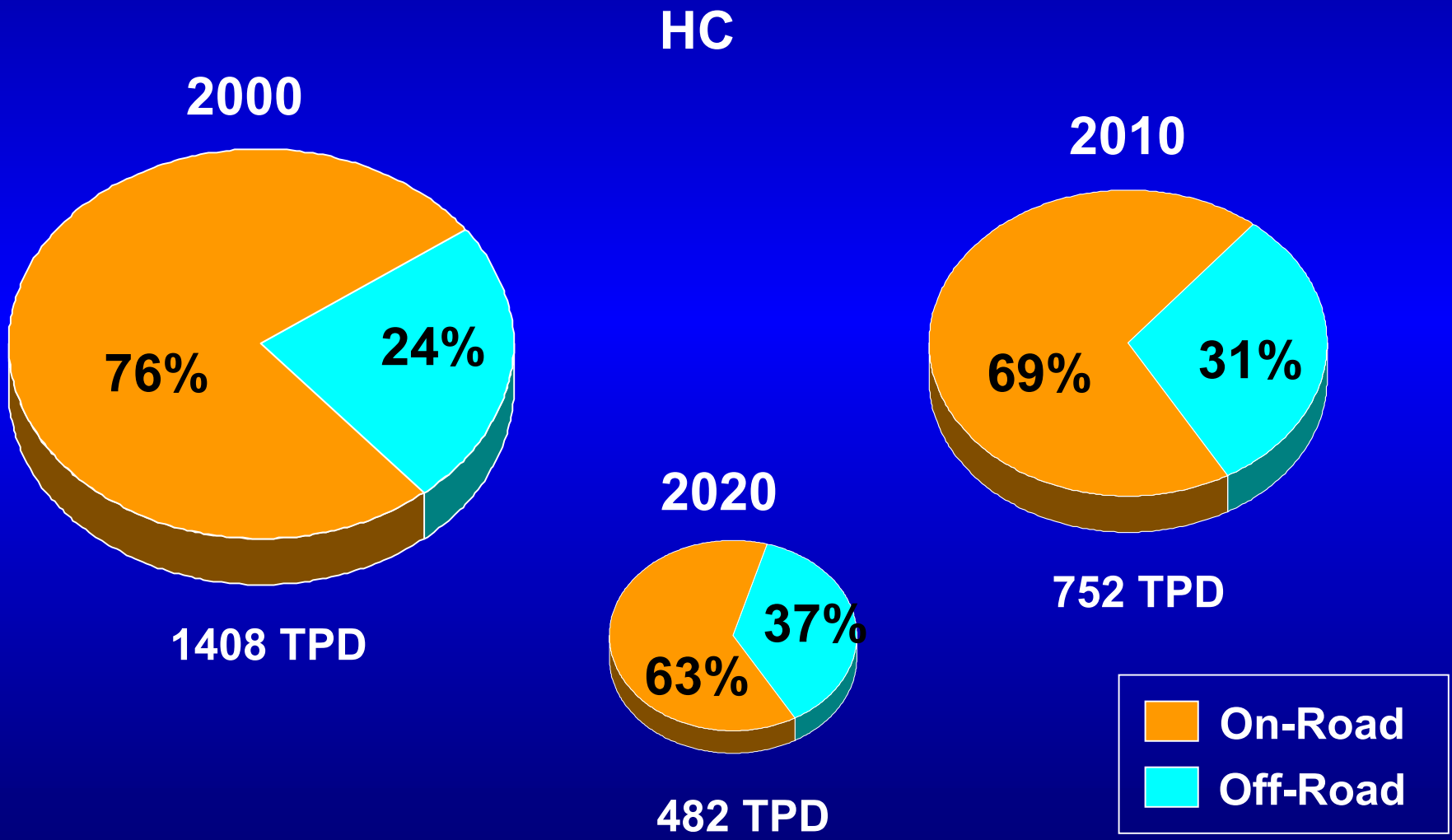
California Environmental Protection Agency

Air Resources Board

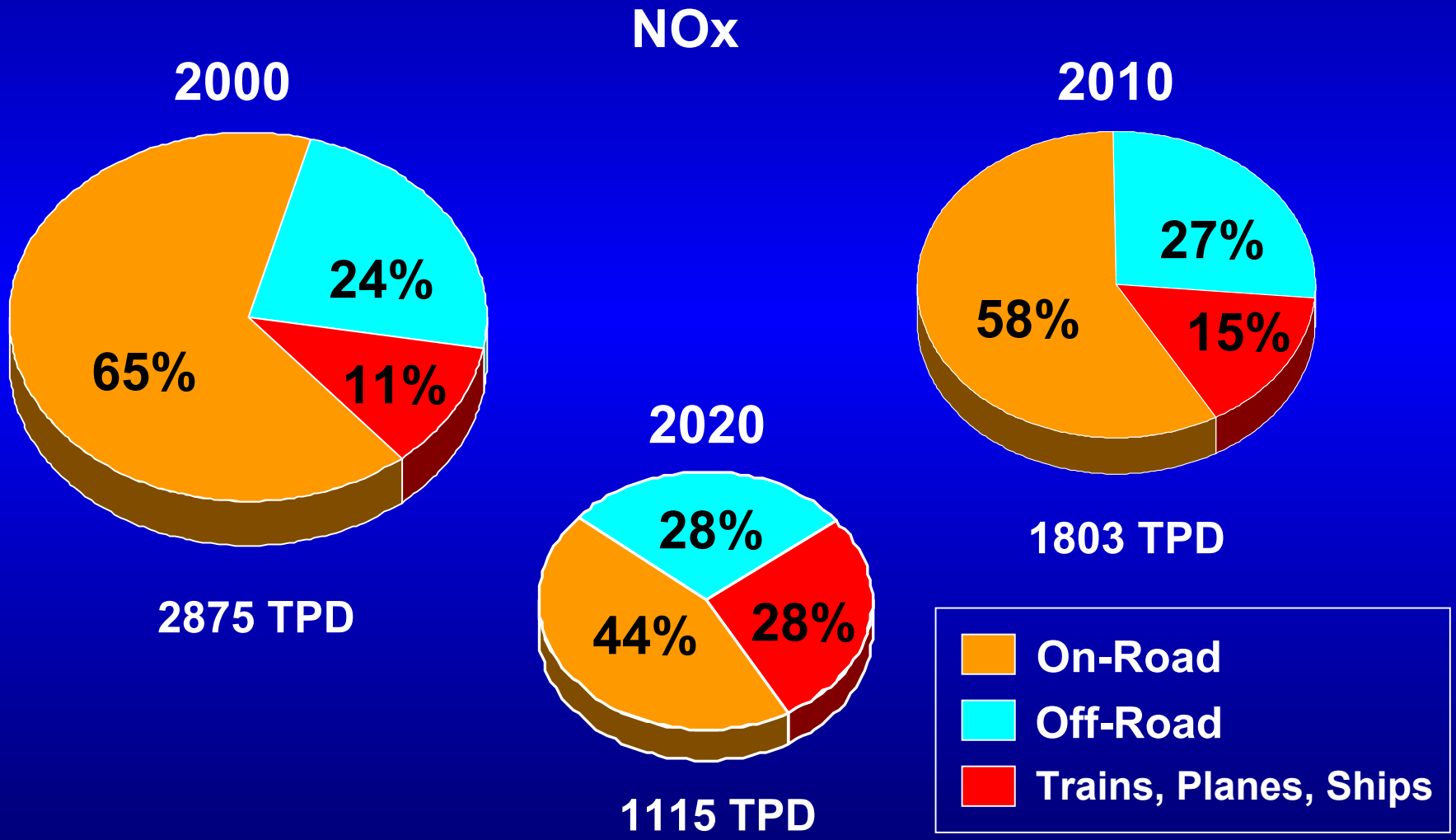
Outline

- Impacts of Off-Road Categories
- Categories
  - Small Off-Road Engines(SORE)
  - Large Spark-Ignition (LSI) Engines
  - Compression-Ignition (Diesel) Engines
  - Recreational Marine
- Past, Present, Future

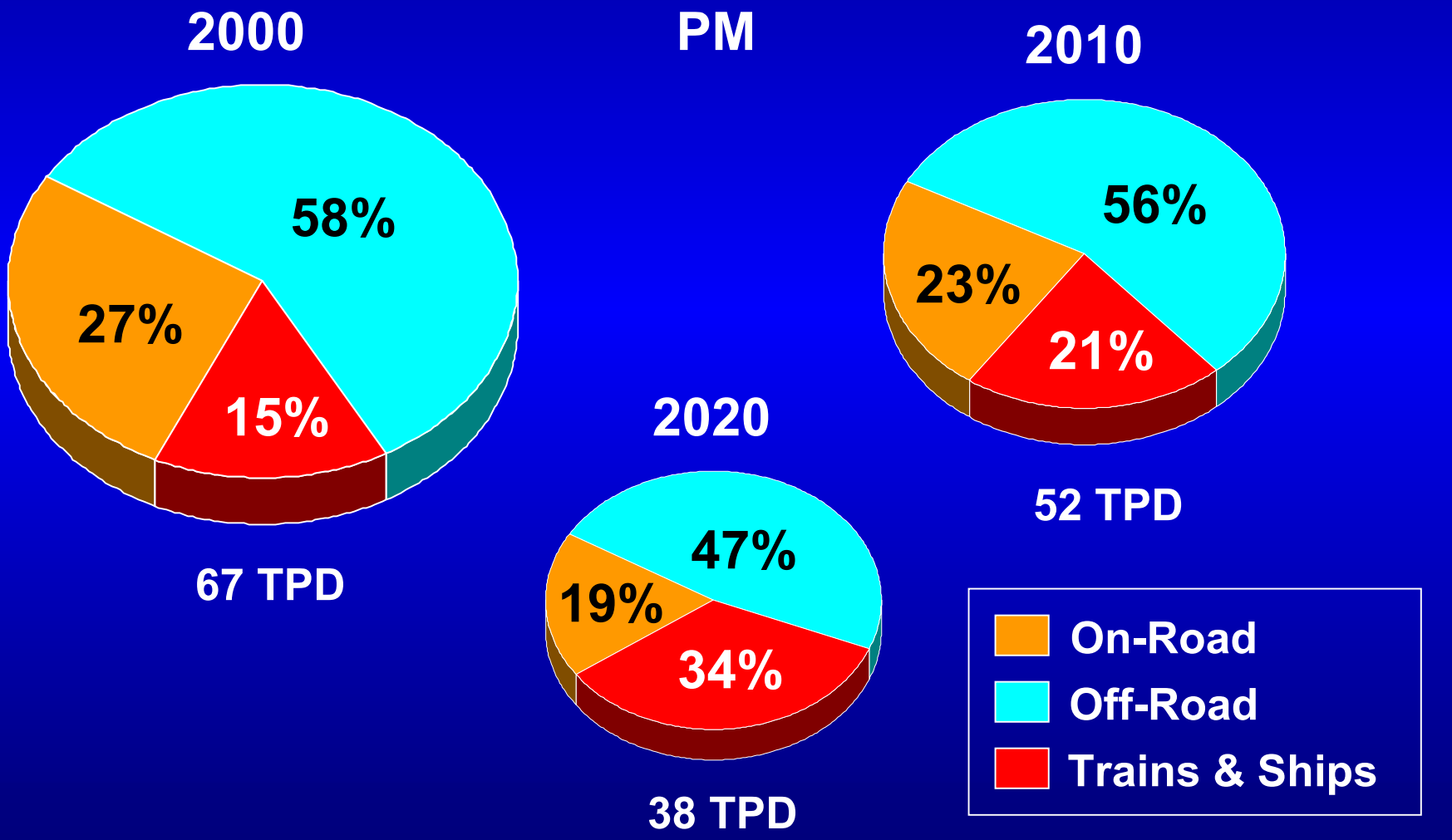
Mobile Sources Statewide Emissions Inventory



Mobile Sources Statewide Emissions Inventory



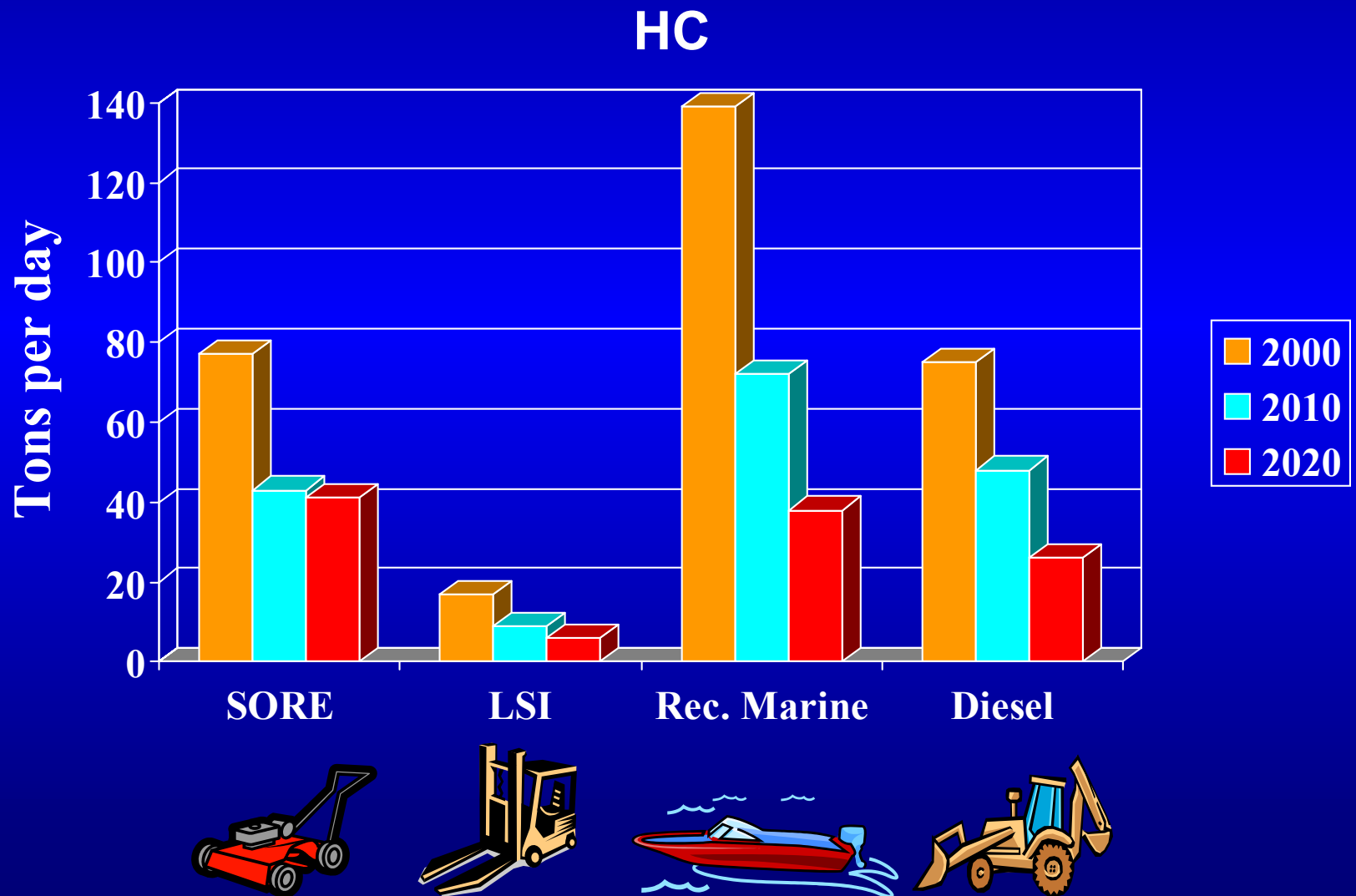
Diesel Mobile Sources Emissions Inventory



Cleaner Off-Road Engines to Meet Our Public Health Goals

- Critical component of SIPs to attain the ozone and particulate matter standards
- 8 off-road SIP measures
- Included state and federal commitments
- Preempt equipment

Category Contributions



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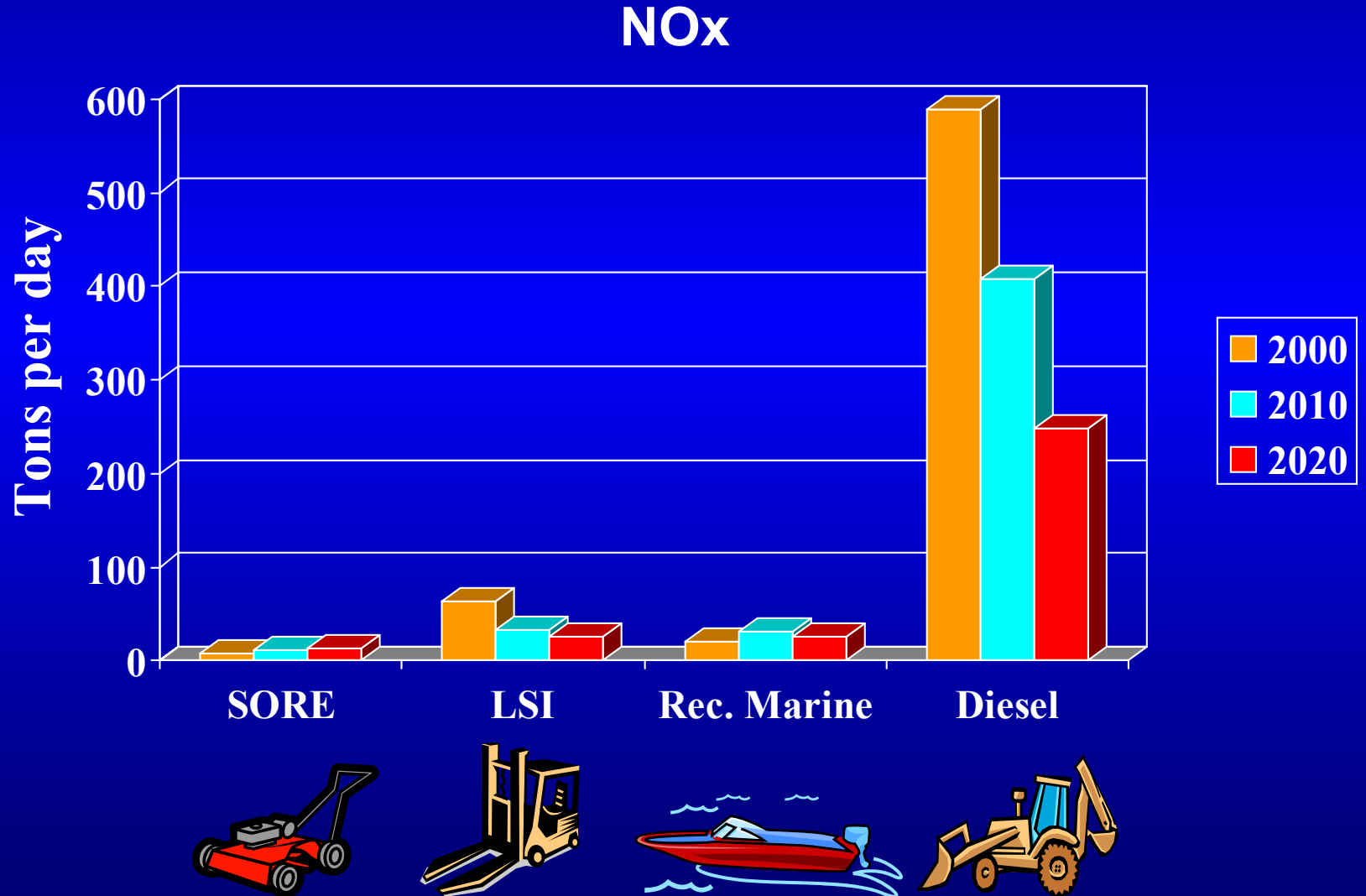
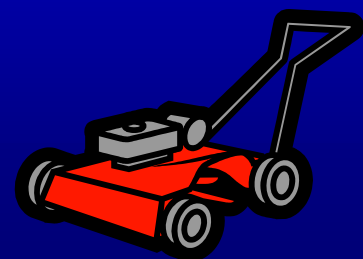


Small Off-Road Engines

Status

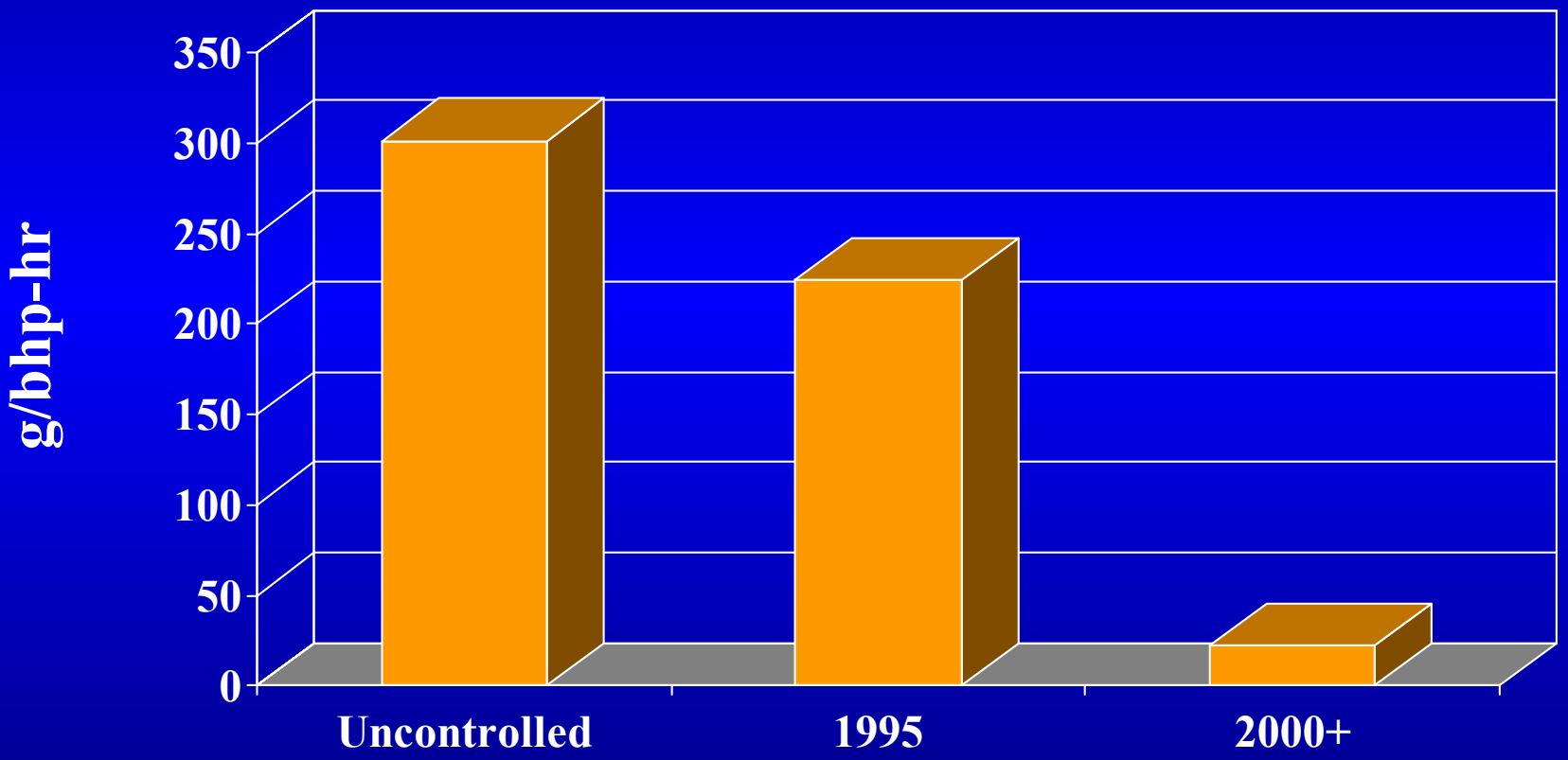
- 1990: Adopted standards
- Tier 1 (1995-1999)
  - Enleanment
  - Engine modifications
- Tier 2 (2000+)
  - Handheld
    - Advanced 2-strokes
    - 2-stroke → 4-stroke
    - Catalysts
    - Switch to electric equipment
  - Non-handheld
    - Side Valve → Overhead Valve



Lower Emissions Levels

< 65cc Engines

HC+NOx



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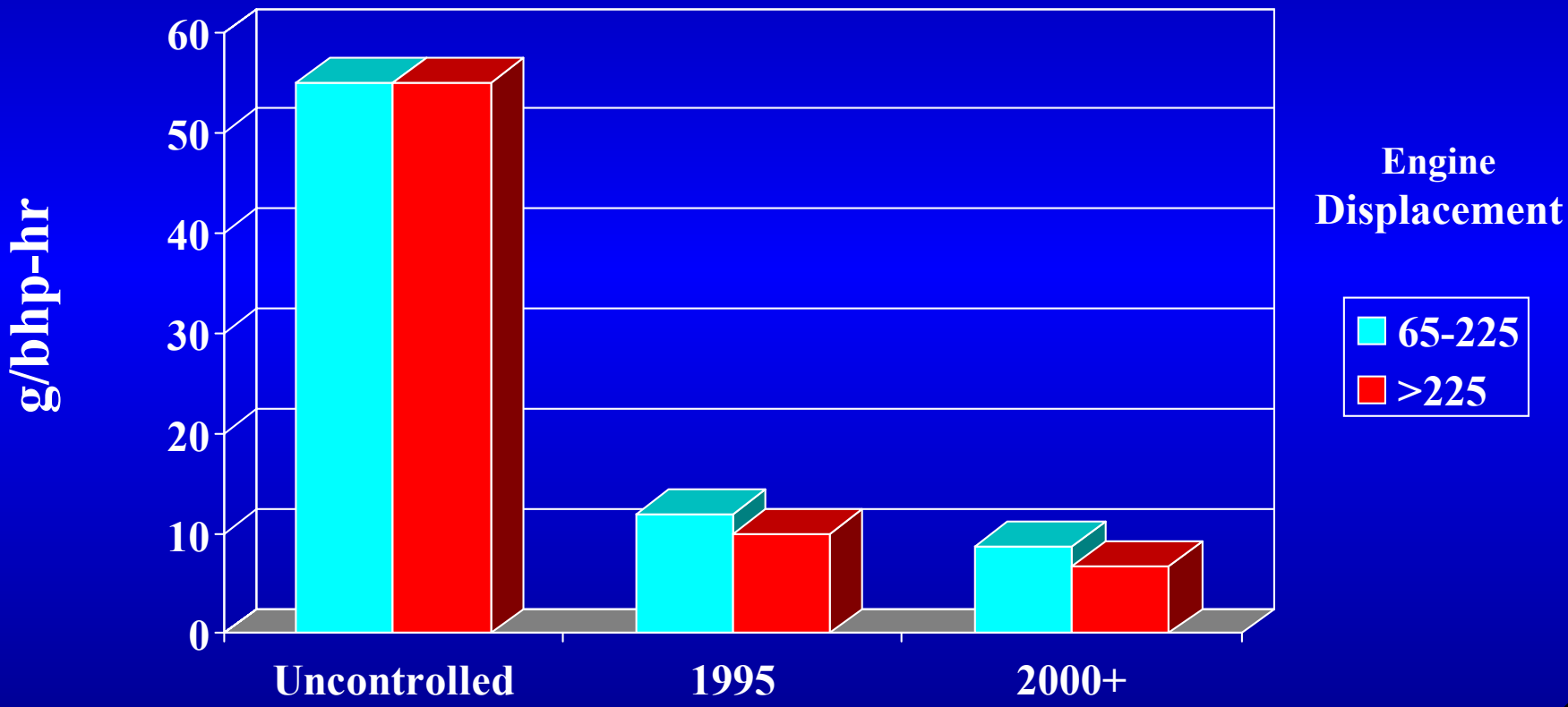
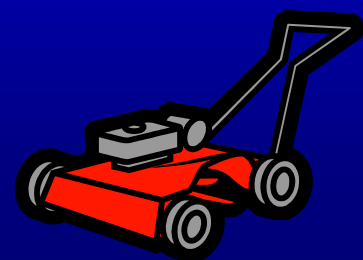
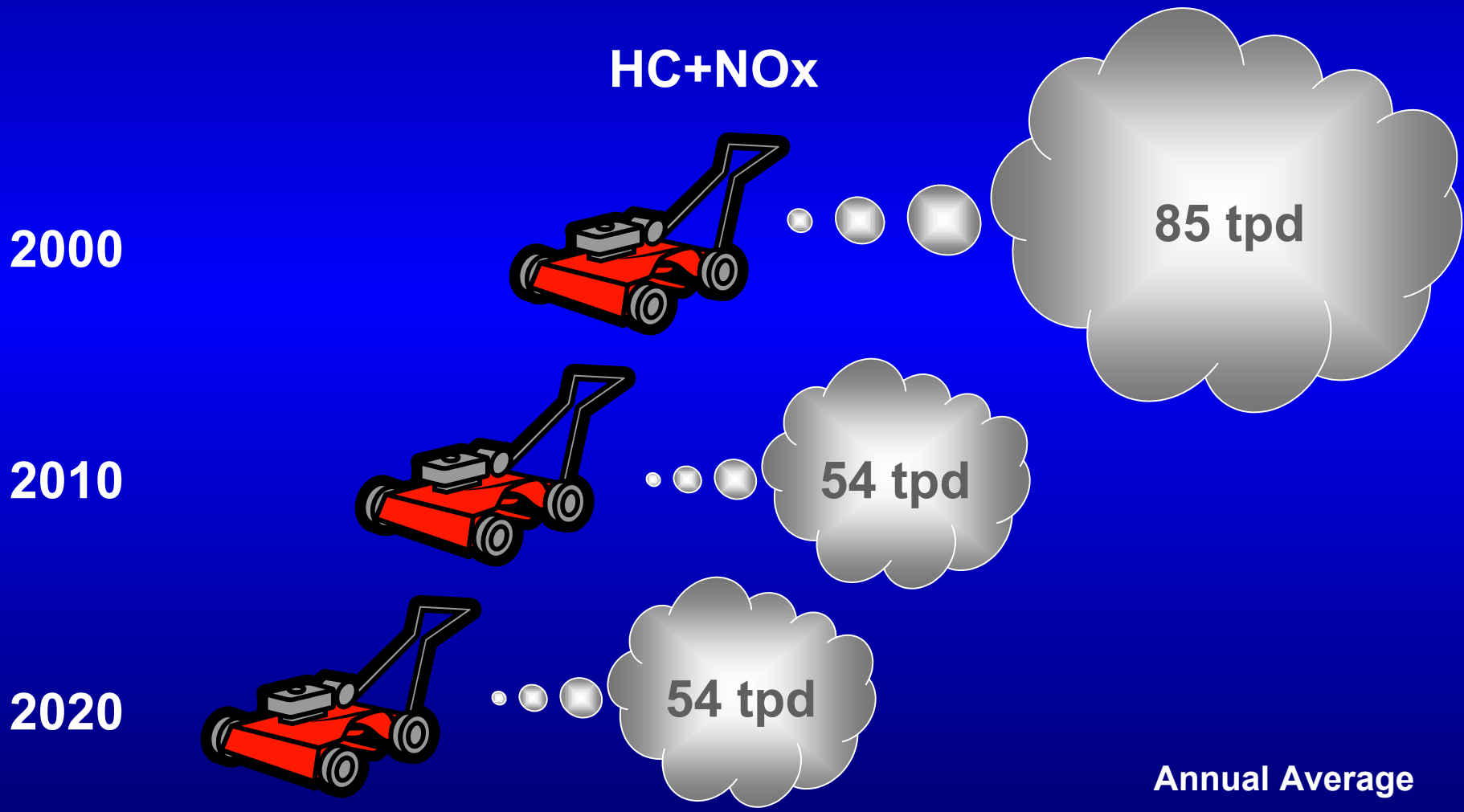




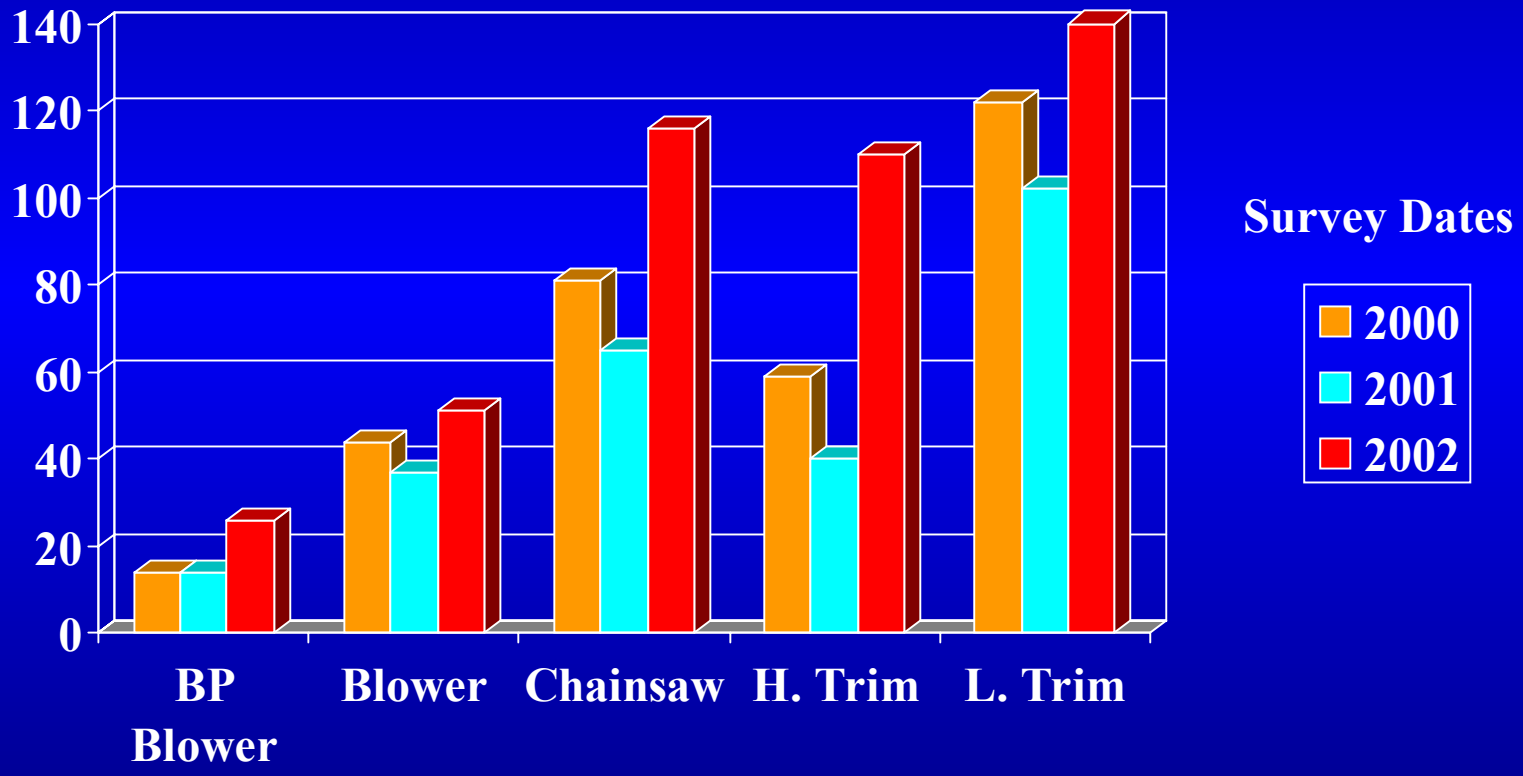
Small Engine Contribution Reduced



Current Status

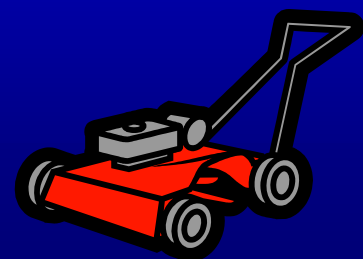
Model Availability

Small Handheld Engines



Additional Reductions from Small Engines are Possible

- Evaporative reductions
  - Approximately: 50% HC reduction by 2020
- Further exhaust reductions
  - Catalyst durability demonstration
  - Expectation: 50%+ HC+NOx reduction
- Propose new standards in 2003

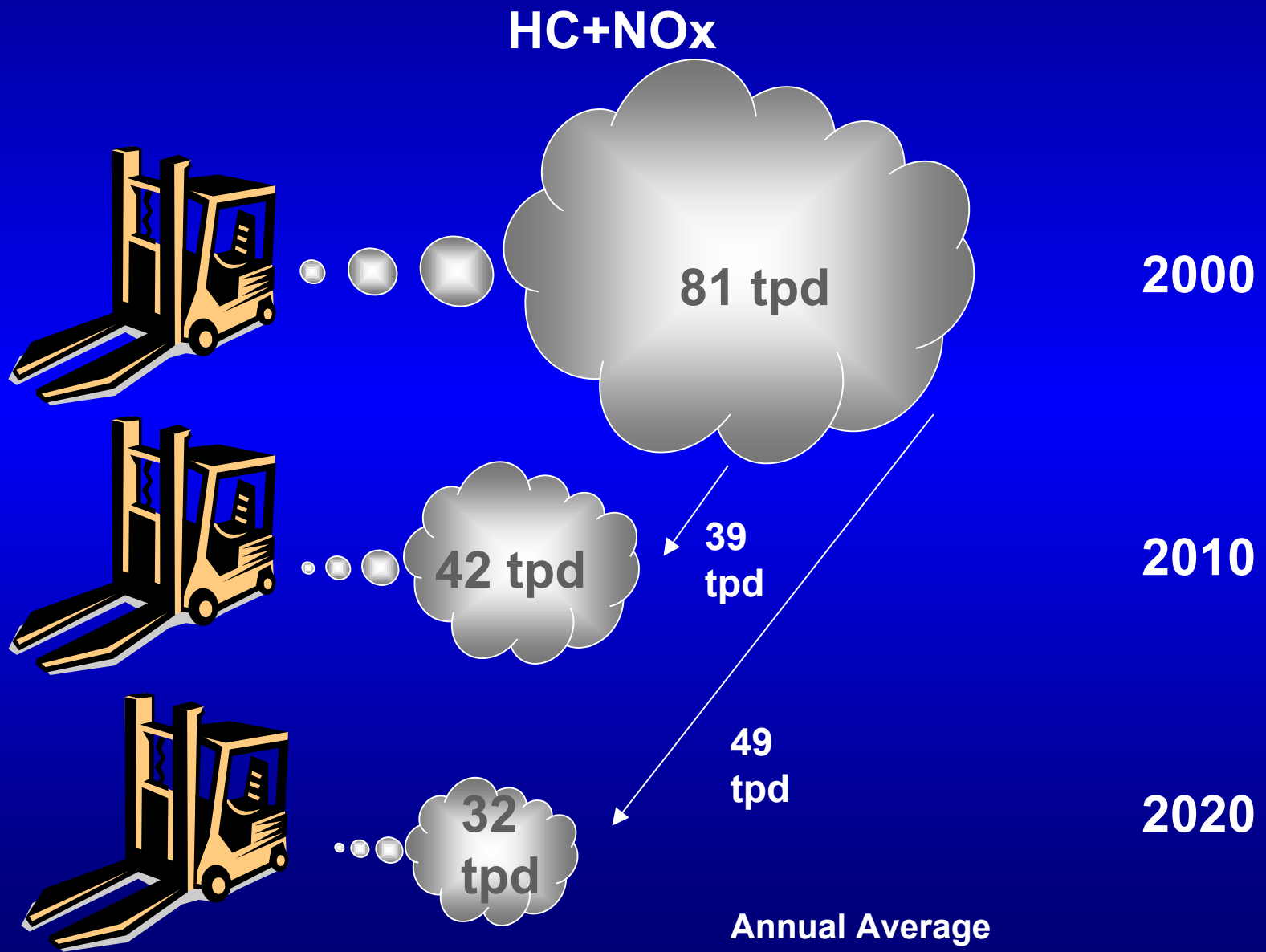


Large Spark-Ignition Engines

Status

- 1998: Adopted catalyst based standards
  - 2001-2003: Phased-in
  - 2004: Fully implemented with a durability requirement
- No reported technical or availability issues
- Manufacturers certified compliant engines
- Most engines well below 3.0 g/bhp-hr standard

Reduced Emissions Contribution



Additional Reductions from LSI Engines are Feasible

- ARB, SCAQMD, U.S. EPA, SwRI
- Closed-loop/catalyst durability demonstration
- Transient test cycle developed
- More stringent emission standards feasible - adopted by U.S. EPA 9/02

Recreational Marine Engines

Spark-Ignition Vessels

Recreational Marine Vessels

I
N
B
O
A
R
D
S

Recreational Marine Vessels

STERNDRIVES

Recreational Marine Vessels

OUTBOARDS

Recreational Marine Vessels

P E R S O N A L

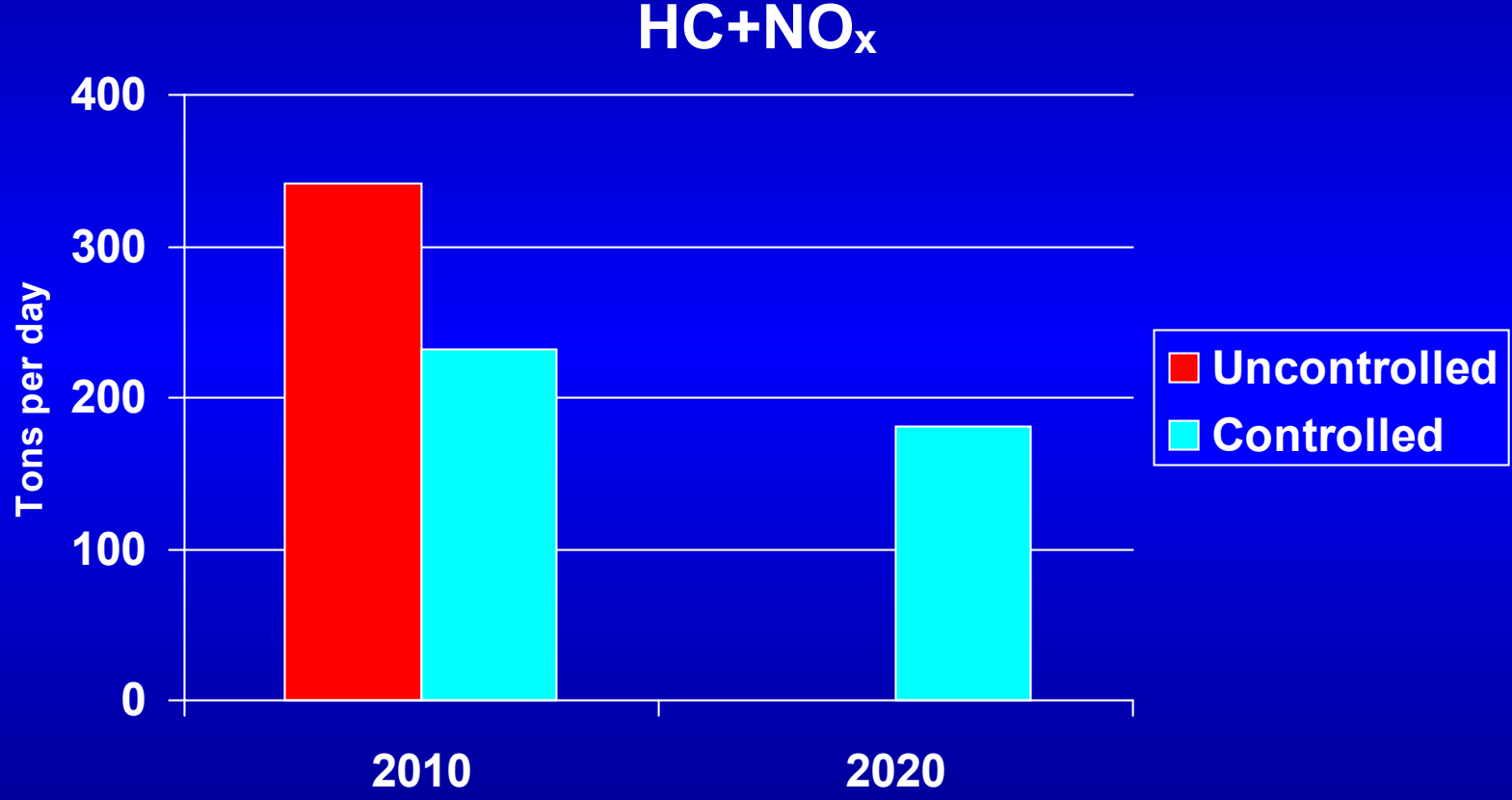
W A T E R C R A F T

History

- 1996: EPA - Outboards/PWCs
- 1998: ARB - Outboards/PWCs
  - 2001: EPA 2006 standards ★
  - 2004: 20% lower standards ★★
  - 2008: 65% lower standards ★★★
- 2001: ARB - Inboards/Sterndrives
  - 2003: Emissions “capped” ★★★
  - 2007: Catalyst-based standards ★★★★

Reduced Emissions Contribution

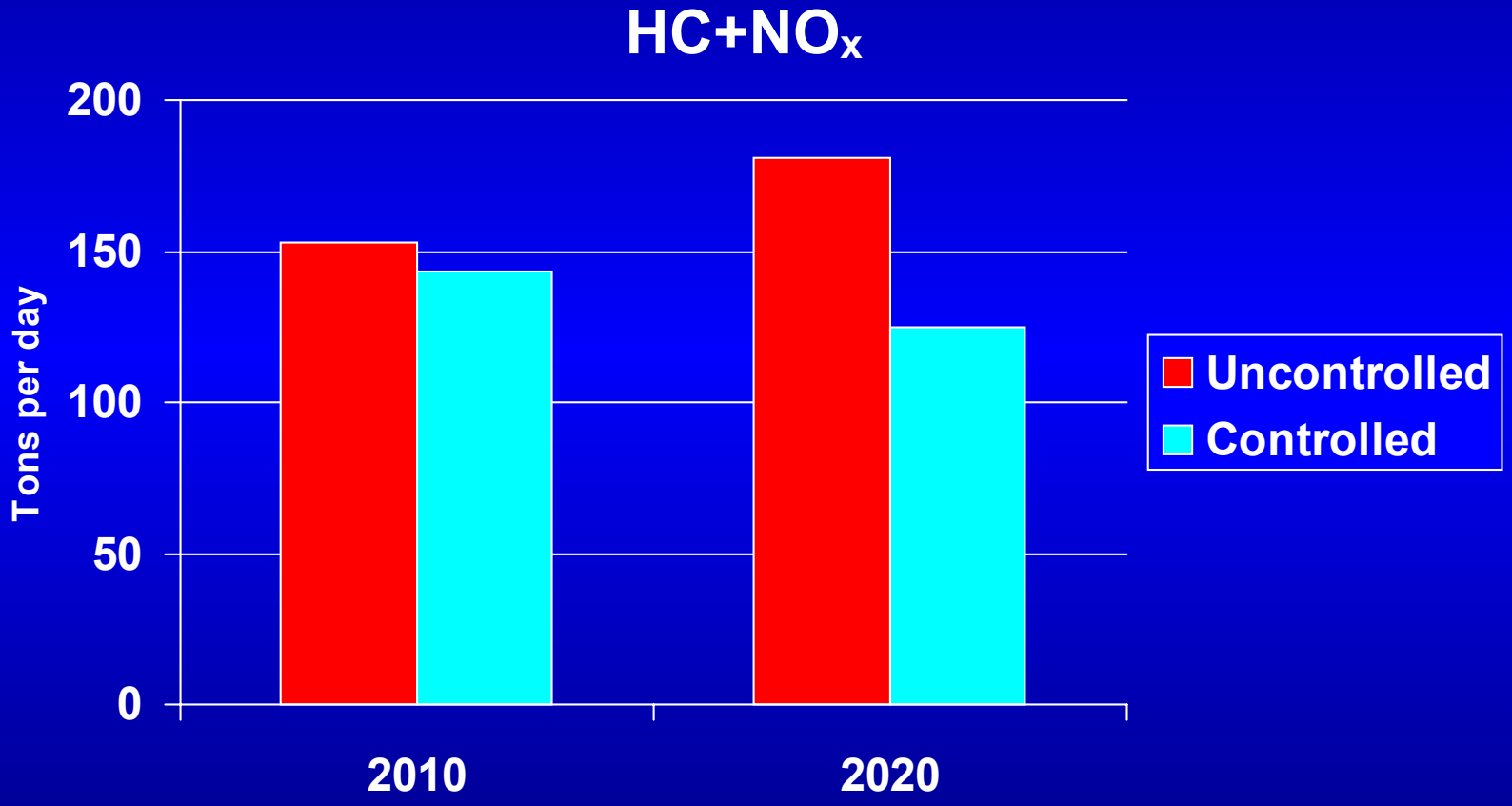
Outboards and PWCs



Statewide Summer Weekend Inventory

Reduced Emissions Contribution

Inboards and Sterndrives



Statewide Summer Weekend Inventory

Clean 2002 Models Available

Vessel	★	★★	★★★
Outboards	1	41	17
PWCs	3	5	—
Inboards	—	—	1

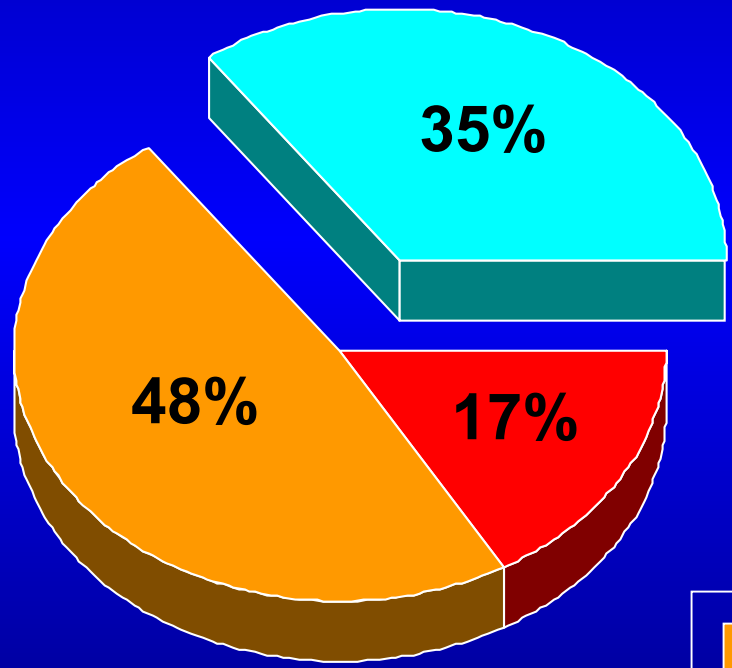
Recent Events

- 2002: EPA - (Proposed) Evap Controls
  - Covers: Outboard - PWC - Inboard - Sterndrive
  - Reduce evap emissions by 80% in 2008 MY
- 2002: ARB - Catalyst Demo Project
  - “In Water” demo of catalyst-equipped boats.
  - ARB, U.S. EPA, U.S. Coast Guard, NMMA, MECA
  - Report conclusions

Compression-Ignition (Diesel) Engines

Mobile Sources Diesel Emissions Inventory

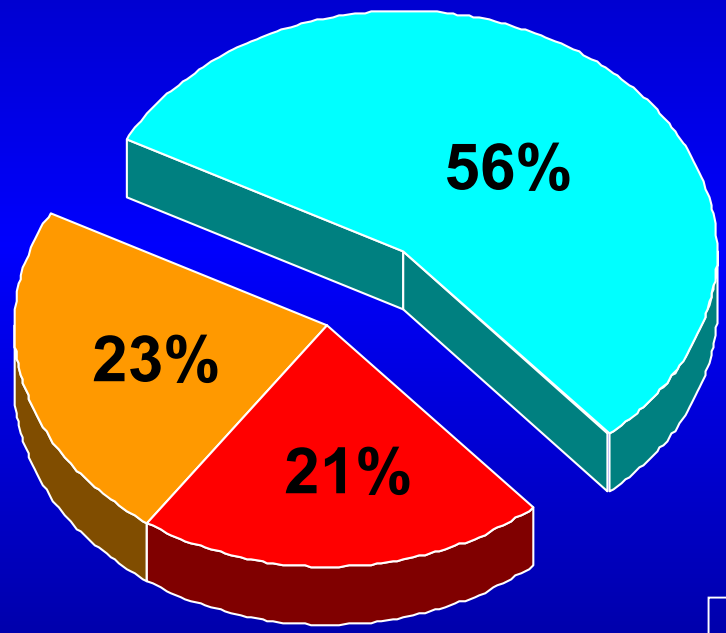
2010 NOx



1165 TPD

Mobile Sources Diesel Emissions Inventory

2010 PM

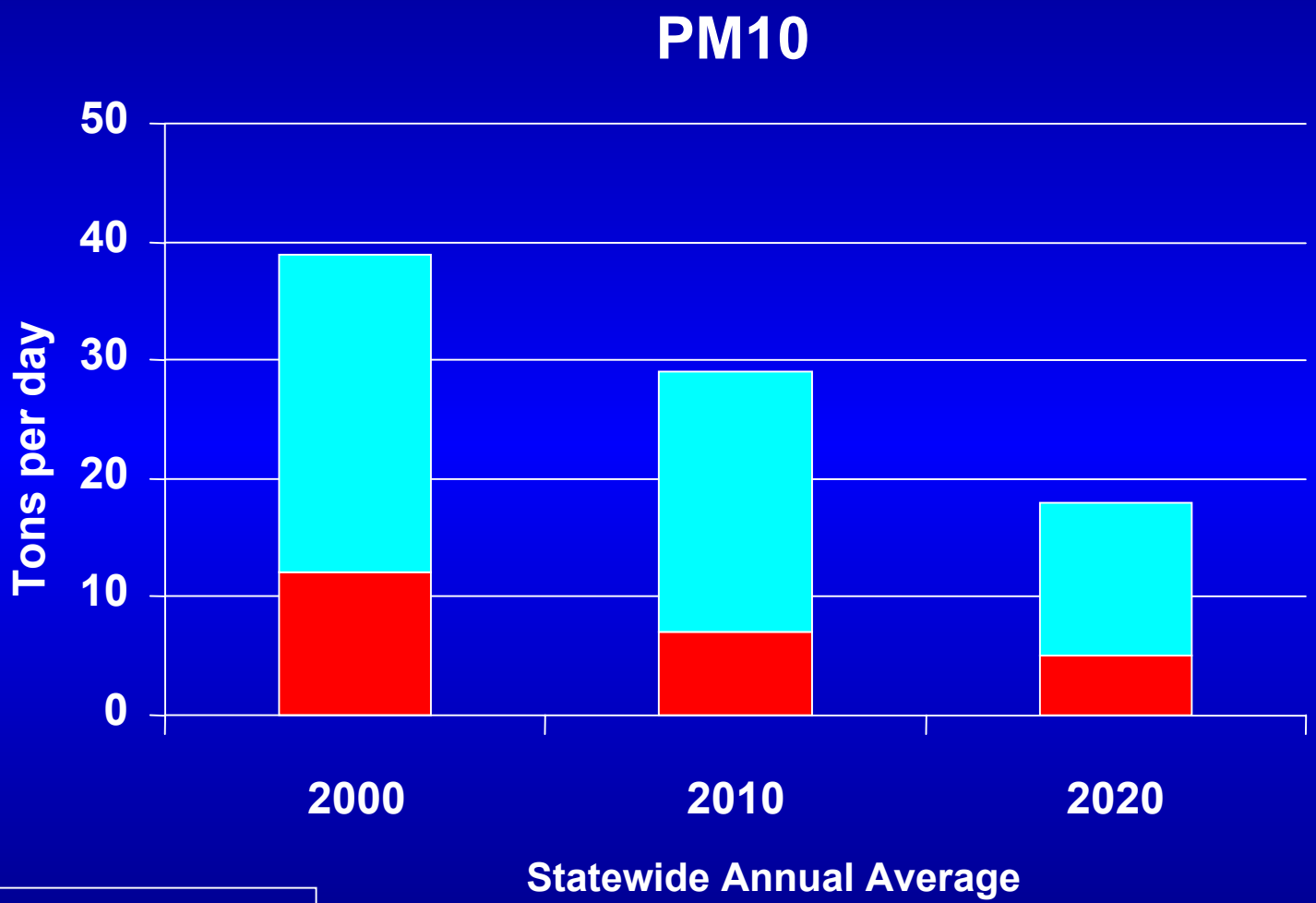


52 TPD

Diesel Engine History

- 1992: California adopts standards early for non-preempt engines
- 1994: U.S. EPA asked to adopt standards for preempt engines
- 1996: Statement of Principles signed by ARB, U.S. EPA, and engine manufacturers
- 1998: Final U.S. EPA diesel rule approved consisting of 3 Tiers of diesel standards
- 2000: California aligns with U.S. EPA

Regulatory Effects on Emissions



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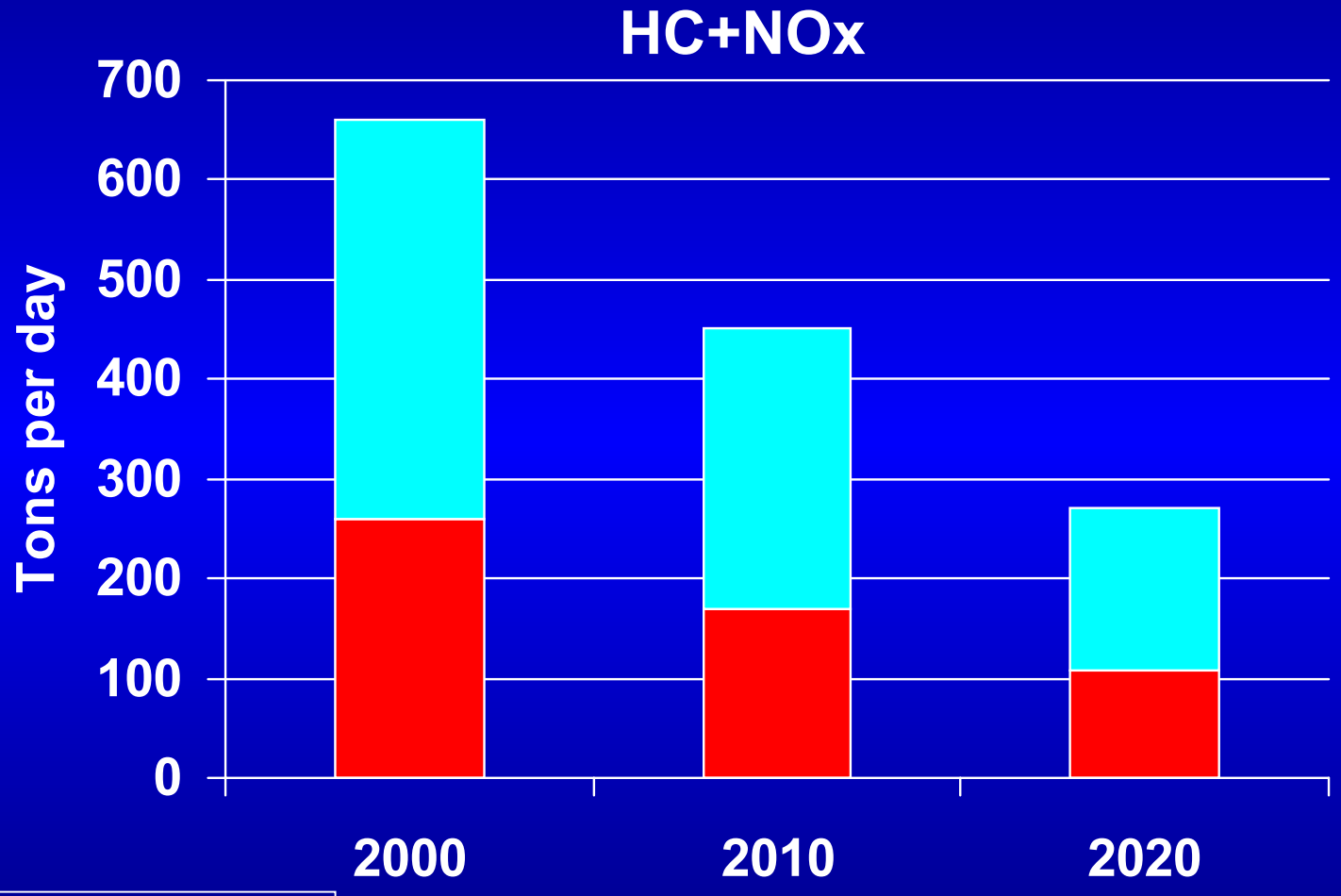
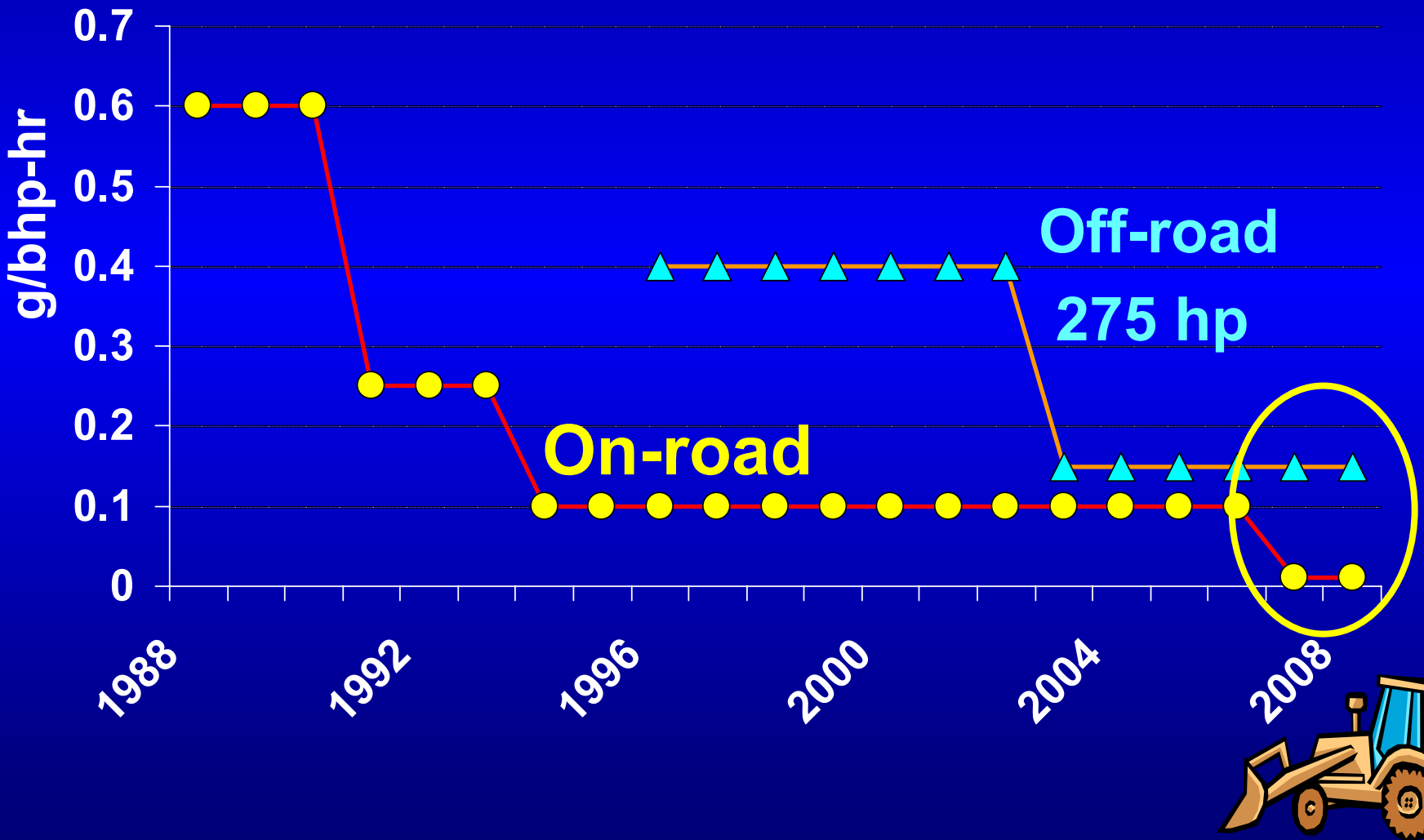


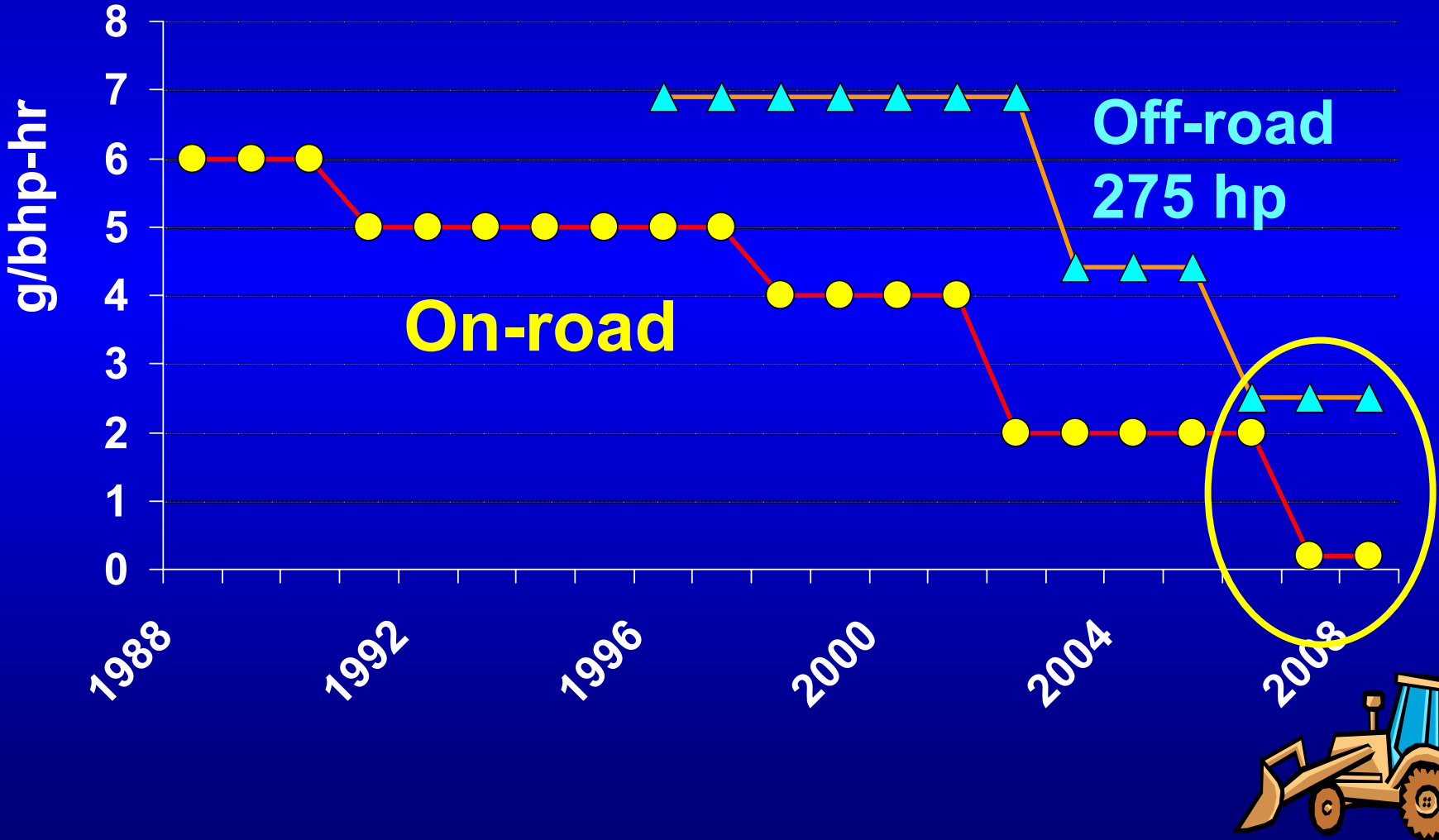
Current Diesel Status

- Availability
  - Sales are virtually unaffected by regulations
  - Engine sales have mostly increased
- Compliance
  - Tier 1 is already fully implemented
  - Tier 2 is in its second year
  - Many engines are ahead of schedule

Off-Road Diesel PM Emission Standards Lag On-Road Standards



Off-Road Diesel NOx Emission Standards Lag On-Road Standards

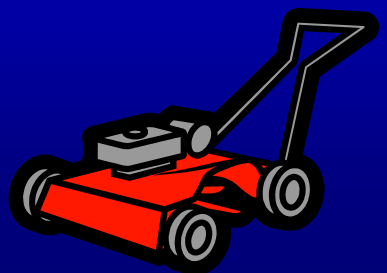


Issues - Reducing Off-Road Diesel Emissions

- Future off-road standards will be patterned after existing 2007 on-road standards
  - PM aftertreatment nearly ready
  - NOx aftertreatment proceeding rapidly
- 15 PPM sulfur diesel fuel required
- Global harmonization of standards desirable

Conclusions

- Emission standards have successfully been implemented for off-road engines
- Compliant products are available in all categories
- Emissions are being reduced
- Staff continues to look for opportunities to further reduce emissions




Conclusions (cont'd)

- Off-road diesel is the largest remaining category of PM and NOx emissions
- On-road technologies are transferable
- More stringent (Tier 4) standards will provide significant improvements in air quality
- U.S. EPA action is necessary